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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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EXAMINER

SAYOC, EMMANUEL

ART UNIT PAPER NUMBER

3746

DATE MAILED: 06/28/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/611,306	MA ET AL.	
	Examiner	Art Unit	
	Emmanuel Sayoc	3746	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 01 July 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-36 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-4, 8-27 and 30-36 is/are rejected.
- 7) ☒ Claim(s) 5-7, 28 and 29 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 01 July 2003 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date <u>1/15/04, 8/12/04</u> . | 6) <input checked="" type="checkbox"/> Other: <u>IDS 7/01/03</u> . |

DETAILED ACTION

Specification

1. The title of the invention is not descriptive. A new title is required that is clearly indicative of the invention to which the claims are directed. The title should refer to at least the principle inventive concept of the claimed invention. The title, "A Fluid Pump with a Piezoelectric Electrode Actuated Tubular Motor for Inducing Impeller and Shaft Rotation"

Drawings

2. The informal drawings are of sufficient quality for examination purposes only. Accordingly, new formal drawings are required at the time the application is allowed. Several drawings have excess shading and poor line quality. Failure to timely submit new formal drawings at the time of allowance will result in **ABANDONMENT** of the application.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

5. Claims 1-4, 8-13, 15-27, and 30-36 are rejected under 35 U.S.C. 103(a) as being unpatentable over Noda (U.S. 6,527,521 B2), and Morita et al. (Non-patent Literature Article 0885-3010, "A Cylindrical Micro Ultrasonic Motor Using PZT Thin Film Deposited by Single Process Hydrothermal Method," IEE Transactions on Ultrasonics, Ferroelectrics, and Frequency Control).

In Figure 1, Noda teaches an axial flow fluid pump for pumping fluid, the fluid pump includes a flow path (P, see flow F) and an urging member (impeller rotor 5, 7) positioned in the flow path.

The Noda device differs from the claimed invention in that there is no teaching of the urging member being coupled to a driver such that selective expansion and/or contraction of a driver body causes the urging member to rotate, thereby urging fluid along the flow path in use.

In Figures 12, and 16-18, Morita et al. teach an ultrasonic motor that is usable as an actuator for a fluid pump. The motor includes a driver (motor shown in Figures 16 and 17) having a substantially tubular shaped body (shown not enumerated) defining a body axis and, a number of elements (see labeled electrodes with corresponding PZT film, Figure 16) circumferentially spaced around the body (shown not enumerated Figure 16). Each element (see labeled electrodes Figure 16) is responsive to a signal to cause a corresponding portion of the body (shown not enumerated Figure 16) to expand or contract in a direction substantially parallel to the tube axis (see Figure 12). The body is constructed of multiple layers consisting of a titanium pipe, a PZT film, and electrodes. These layers constitute a plurality of elements circumferentially spaced around the body and arranged in a plurality of layers (see Figure 16). The PZT layer constitutes an intermediate electrode contacting adjacent surfaces of the layers of the elements, and the outer electrodes contact exterior surfaces of the PZT layer to define a tubular motor body. As is seen by the U.S. Patent and Trademark classification class 417, subclass 423.1, the use of motors to drive rotary non-expansible chamber pumps (impeller type pumps) was well known in the art at the time the invention was made. Noda is an example of such rotary non-expansible chamber pumps. Furthermore the Morita et al. motor has high torque at low speeds, is simple in structure, does not require complicated gear boxes, and has relatively larger mechanical output power than similar type motors (page 1178 paragraphs 1-3). Therefore it would have been obvious to one of ordinary skill in the art at time the invention was made to modify the Noda device by, applying the ultrasonic motor, as taught by Morita et al., in order to

advantageously utilize a motor that features high torque at low speeds, simplicity in structure, no requirement for complicated gear boxes, and relatively larger mechanical output power.

In the combination, the elements are piezoelectric elements (Morita et al. page 1152 paragraph 1, and Figure 12). The elements extending substantially along the length of the body (Morita et al. Figure 16), and the body has a diameter of less than 0.1m, and a length of less than 1m.

It would have been obvious that a controller is employed in Morita et al. that is coupled to the elements, to automatically and precisely generate electrical signals thereby causing the selective expansion and contraction of the elements (also see Figure 21).

As in Morita et al. Figures, 12, 17 and 21, it is evident that the elements (shown not enumerated) are arranged in pairs, each pair being positioned in circumferential opposition. The controller is adapted to generate electrical signals to thereby selectively activate an element pair such that one of the elements expands and the other element contracts.

As seen in Morita et al. Figure 12, the controller is adapted to activate each element pair in turn, to thereby cause the elements to expand and contract in a circumferential sequence. In such sequence of opposing element actuation, it is obvious that the element pairs are 180 degrees out of phase.

With respect to the type of power source and the voltage and frequency levels, where the general conditions of a claim are disclosed in the prior art, it is not inventive

to discover the optimum or workable ranges by routine experimentation. In re Swain et al., 33 CCPA (Patents) 1250, 156 F.2d 239, 70 USPQ 412; Minnesota Mining and Mfg. Co. v. Coe, 69 App. D.C. 217, 99 F.2d 986, 38 USPQ 213; Allen et al. v. Coe, 77 App. D.C. 324, 135 F.2d 11, 57 USPQ 136.

In the combination above, Noda in Figure 2 teaches a prior art shaft and rotor impeller assembly including a cylindrical shaft (142a) defining a shaft axis that extends along the flow path (F) and, blades (142b) extending radially outward from the shaft (142a). The blade extends circumferentially around the shaft (142a) and along the shaft axis, such that rotation of the shaft causes the blade (142b) to urge fluid in a direction substantially parallel to the shaft axis. The shaft (142a) ends are tapered. As the impeller shaft assembly is not a central concept of the claimed invention, or the prior art devices, it would have been obvious to one of ordinary skill in the art at the time the invention was made to utilize the above described impeller and shaft assembly in the combination of Noda and Morita et al. Making this modification would not significantly change the function of the Noda, as modified by Morita et al. device. Furthermore the applicant has not provided any criticality or un-obvious advantage of this particular impeller and shaft assembly. In fact the applicant claims a plurality of shaft and impeller arrangements, which is evidence that this is not a critical or central aspect of the claimed invention.

Noda in Figure 1 teaches a shaft (5) that is substantially tubular.

Mortia et al. (Figure 18) shows a preload mechanism as disclosed in the claimed invention. Mortia et al. in this figure discloses a practical implementation of the motor.

Art Unit: 3746

In the combination and in accordance to the teaching in this figure, the impeller-urging member would include end caps (shown not enumerated) for coupling the shaft to the motor driver. The end caps are shown to have a frustroconical shape. The end caps are urges against the piezoelectric elements. One of the end caps is coupled to the shaft by a spring member, which is adapted to urge the end cap against a respective end of the piezoelectric element.

With respect to the exact cone angle of the end caps, and the exact spring constant of the spring, where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation. In re Swain et al., 33 CCPA (Patents) 1250, 156 F.2d 239, 70 USPQ 412; Minnesota Mining and Mfg. Co. v. Coe, 69 App. D.C. 217, 99 F.2d 986, 38 USPQ 213; Allen et al. v. Coe, 77 App. D.C. 324, 135 F.2d 11, 57 USPQ 136.

The Noda device is disclosed to pump blood – see Abstract.

6. Claim 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over Noda, as modified by Morita et al., as applied to claim 13, and in further view of Benkowski et al. (U.S. 5,947,892).

Noda, as modified by Morita et al., set forth a device as described above, which is substantially analogous to the claimed invention. The Noda, as modified by Morita et al. device differs from the claimed invention in that there is no teaching of the pitch of the impeller thread varying along the length of the shaft. Benkowski et al. in Figure 1

Art Unit: 3746

teach an analogous blood pump. The impeller and shaft assembly (46, 60) has a pitch thread varying along the length of the shaft. As taught in column 7 line 1-10, the gradual change in pitch allows for smoother blood acceleration thus reducing blood hemolysis. As the Noda pump is also used for blood pumping, it therefore would have been obvious to one of ordinary skill in the art at time the invention was made to modify the Noda, as modified by Morita et al., device by, incorporating the pitch of the impeller thread varying along the length of the shaft, as taught by Benkowski et al., in order to advantageously reduce blood turbulence and hemolysis.

Allowable Subject Matter

7. Claims 5-7, 28, and 29 objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Conclusion

8. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. The following references are cited to further show the state of the art with respect to impeller pumps.

U.S. Pat. 6,080,133 to Wampler, and 5,370,509 to Golding et al. – teach blood pump impellers and shaft assemblies similar to that of the claimed invention.

Art Unit: 3746

U.S. Pat. 6,592,335 B2 to Rosefsky, and 3,305,825 to Godbey – teach impeller and shaft assemblies similar to that of the claimed invention.

U.S. Pat. 5,761,782 and 5,798,600 to Sager – teaches a similar impeller and shaft assembly similar to that of the claimed invention.

Contact Information

9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Emmanuel Sayoc whose telephone number is (571) 272 4832. The examiner can normally be reached on M-F 8-5pm.

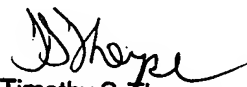
If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Timothy S. Thorpe can be reached on (571) 272-4444. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

ECS



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Examiner
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